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ABSTRACT

This unit on fossils is designed for junior high school students. Students collect a sediment sample, process the sample, and examine it for microfossils. The scientific classification and naming of microfossils is not stressed. Included in the materials are evaluation items, background materials for teachers, lists of needed materials, vocabulary list, and student materials. (BH)

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MICROFOSSILS FROM THE LOCAL MARINE ENVIRONMENT

A Learning Experience for
Coastal and Oceanic
Awareness Studies

Produced by

MARINE ENVIRONMENT CURRICULUM STUDY
MARINE ADVISORY SERVICE
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and

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COLLEGE OF EDUCATION
UNIVERSITY OF DELAWARE

as part of a

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Please send evaluations

of learning experiences

to

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TITLE: MICROFOSSILS FROM THE LOCAL MARINE ENVIRONMENT

* CONCEPT: I.B.4.a.

I. The earth is a finite natural system.

B. All living things have arisen from and are dependent upon the natural system of the earth.

4. The interaction of organisms with their environment leads to great diversity and wide distribution of organisms.

a. NATURAL SELECTION LEADS TO EVOLUTION.

** MARINE CONCEPT: 3.14

3. Marine organisms interact in complex ecosystems.

3.1 Life probably originated in the marine environment.

3.14 THE MARINE ENVIRONMENT HAS SUPPORTED THE EVOLUTION OF A DIVERSITY OF SPECIES.

GRADE LEVEL: 7-9

SUBJECT: Science

CLASS PERIODS: Various

AUTHOR: Osterholm

I. Introduction

The study of microfossils is a growing field of interest to students of geology, biology, and topics relating to the past habitat of the earth.

Many paleontologists were interested in fossils at an early age and continued this interest in later career occupations relating to this general topic.

Students in the junior high have a great interest in little known forms of life in their environment.

* From A Conceptual Scheme for Population-Environment Studies, 1973. Cost $2.50.

** From Marine Environment Proposed Conceptual Scheme, 1973. No charge.

Both conceptual schemes are available from Robert W. Stegner, Population-Environment Curriculum Study, 310 Willard Hall, University of Delaware, Newark, DE 19711.

The basic skills that an expert marine micropaleontologist needs to find microfossils can be learned by junior high students of all ability levels.

In this unit on microfossils, students will collect a sediment sample, process this sample, and examine it for microfossils. The student must follow certain steps in an orderly progression to reach the final activity of picking microfossils from the sample on a slide. The scientific classification and naming of microfossils is not stressed.

II. Goal of Lesson Plan

A general investigation of local microfossils can be very interesting and rewarding for junior high students studying biology, geology, or earth science. This unit will teach many practical laboratory techniques. Knowledge of microfossil terminology and classification is not important; these aspects of microfossil study are left for future inquiry by your students in later years after general interest has been initiated by this unit.

III. Instructional Objectives

A. Students will collect sediment samples from the local marine environment.

B. Students will find microfossils in collected samples of sediments.

C. Students will demonstrate their skills in following a systematic procedure in picking and collecting microfossils.

D. Students will identify different types of microfossils in their samples.

Major concepts: Microfossils live in the local marine environment.

Various types of microfossils live in salt water.

Microfossil remains collect in the substrates of marine habitat.

IV. Foraminifera: the most abundant microfossils

The most abundant microfossils in recent sediment samples are the shells of foraminifera. Foraminifera shells can be any one of thousands of shapes, from round to long and narrow. The best way to describe a foraminifera shell is to refer to an object that in some way resembles the shell. Most foraminifera shells will be unique in shape and not easily confused with grains of sand.

The foraminiferan is a one-celled animal that protects itself with a shell (called a test) usually composed largely of silica, or calcium carbonate. This shell is either smooth and shiny, ornamented with ridges or small holes. Most foraminifera shells are coiled in a circle like a rope or spiral. Many will be white or gray, and they may have the appearance of mud particles glued together. The size of a foraminiferan can range from the sediment size to much smaller.

The shells of foraminifera usually have many increasingly larger sections called chambers built one at a time by the foram as it grows and enlarges. Chambers are marked by small ridges on the shell surface. At the end of the last chamber will be an opening of some shape called an aperture.

This aperture provides a channel to the newest chamber, where the foraminiferan lives. Many physiological processes occur through this opening. To collect food the organism extends part of its cell material, a false-foot or pseudopod, through this opening to the outside.

Many foraminifera live among the bottom muds of salt and brackish water habitats, such as the Delaware Bay, Chesapeake Bay, Rehoboth Bay, Indian River, and lower Choptank River. All these marine environments have favorable conditions of water temperature,

dissolved oxygen, food supply and salinity. After the foraminifera die, shells collect on the bottom together with such materials as silt, clay, sand grains, and detritus (decayed organic matter). Some foraminifera live in the open ocean; when they die their shells may be deposited on the ocean floor or carried by tidal currents to estuarine environments. (The bibliographyon p. 16 lists sources with more detailed information on foraminifera.)

V. Other Common Microfossils

Diatoms

Diatoms are one-celled marine plants whose skeletons are made of silica, a component of glass. A diatom can be long and narrow, round and flat, round and bent, or even triangular. Diatoms are so small that they are often overlooked. Most are translucent.

Copepods

The copepod is a small crustacean found in salt water. Its skeleton may be found in sediment samples and easily identified. The body of a copepod is divided into two parts: 1) the fused head and upper body and 2) the abdomen. Copepods somewhat resemble shrimp.

Amphipods

The amphipod is a small crustacean that lives on the bottom. It has an exoskeleton (shell) and seven pair of appendages. These appendages, which vary in size, are used for different functions. In some species, the two eyes are extremely large.

Scolecodonts

Scolecodonts are found in sediments from early geological time to the present. These microfossils look like fish bones, but they are actually jawbones of annelid worms. The teeth on the jawbone of different species vary in length and arrangement.

Pre-Test

1._____Which of these creatures is not microfossil?

a. copepod
b. diatom
c. foraminifera
d. worm

2._____Which equipment is best to use to wash mud from sand?

a. shovel
b. spade
c. screen sieves
d. net

3._____The best instrument for looking at foraminifera is a _____.

a. magnifying glass
b. unaided eye
c. telescope
d. microscope

4._____Foraminifera live in_____.

a. fresh water
b. salt water
c. either

5._____Pseudopodia can also be called _____.

a. false feet
b. colored animal
c. fake head
d. small fish

6._____The main reason for sieving a sediment sample is to _____.

a. Remove tiny shells
b. Separate sediments by size
d. Dissolve salt from sediment sample

7._____Microfossils are usually studied as shell remains.

True or False

8._____Foraminifera are used to date ancient sediments.

True or False

9._____Most microfossils are large enough to be seen in a sample of sediment without special equipment.

True or False

10._____On a dissecting microscope the lowest power shows the _____.

a. largest area of vision
b. smallest objects
c. smallest of vision

Answers for Pre-Test

1. D, worm
2. C, screen sieves
3. D, microscope
4. B, salt water
5. A., false foot
6. B, separate sediments by size
7. T, true
8. T, true
9. F, false
10. A, largest area of vision

VI. Materials Needed in Order of Use

1. Jars for samples (one per student)
2. Alcohol - to preserve samples
3. Set of screen sieves (the 3 to 6 inch size is sufficient)
4. Water source for wet sieving
5. Aluminum foil (one roll)- to make drying dishes for sieve subsample
6. Oven for drying samples (optional)
7. Trays made of sheet metal painted with flat-black enamel (one per student)
8. Dissecting or stereomicroscope (one per student)
   Compound Microscope (one per student)
9. Camel's hair brush (watercolor size)
   Dissecting needle
10. Paper slide for mounting specimens
11. Drawing materials for each student (pencils, chalk, felt-tip markers; drawing paper, transparencies, tracing paper)
12. Transparencies of student drawings of microfossils

VII. Collecting Substrate Samples from Marine Environments (Field Procedure)

When foraminifera, diatoms, or copepods die, their remains sink to the bottom and settle among detritus, silt and clay particles. Samples should include the top one-quarter inch of bottom mud. In shallow water, the sample can be taken by hand; in deep water the sample can be extracted by diving or by the use of a mechanical bottom grab.

Deposit the sample in a vial or small bottle and add a preservative such as alcohol.

Label the sample bottle to indicate location, water depth, and any other physical factors that are noteworthy. Mark the number of the sample and its location on a map of the area.

VIII. Preparing A Sediment Sample in the Class Laboratory
(Wet Sieving)

Place a tablespoon portion of the sample onto the screen sieve set and slowly work the sediments through the screen openings by running tap water through the series of sieves. Use caution not to push sediments through the screen with your fingertips as this enlarges the screen openings. Throw away the largest sieve residue; keep all other sediment sizes. Make sure that all clay is dissolved and washed from the sieves. If too large a quantity of sample is used, the screen openings will become clogged and water will back up in the sieve sizes.

Remove the sediment sample from each sieve individually and place these samples into shallow containers (trays made of aluminum foil or petri dishes) to dry. The samples can be placed in an oven at 350°F. and baked until completely dried; this speeds up the drying time by many hours. The sample is now ready for microscopic examination.

IX. Picking Microfcssils from Sediment Samples

Examine the sediment samples from each sieve separately. Do not mix the sediments of different sizes.

A small tray is needed to look at microfossils through a dissecting microscope. This tray can be shaped from light sheet-metal and then painted with flat-black enamel. To move sediments on the tray use a fine hair paint brush or a long needle. Before picking up a microfossil from the tray, dampen the brush; then touch this brush to the microfossil and lift it gently from the sample to a slide. The use of a dissecting microscope is recommended. Slide the tray around while looking through the lens. To touch the brush to a shell, first focus the brush by looking through the lens and then move the brush hairs down to the microfossil.

Prepare a paper slide with a black background. If you glue specimens down use glue which can be dissolved with water. This is important because you may want to regroup the fossils later.

X. Grouping Microfossils

Place your microfossils into general groupings using source books. Most common groupings for microfossils are: Foraminifera, Diatoms, Copepods, Scolecodonts. You may work with another student on this activity.

XI. Drawing Microfossils from Samples

Many details of microfossils will not be appreciated until the students make large-scale drawings of them. Artistic ability is not necessary. All pictures on pp. 17-29 have been reproduced from student drawings.

Post Test

Identify three pictures of different types of microfossils. (Use transparencies made from student drawings.)

1.
2.
3.

4. Arrange these science materials in order of their use in microfossil study: screen sieves, alcohol, map, microscope.

5. The most common microfossils are the _____.

a. Diatoms
b. Copepods
c. Foraminifera

6. Screen sieves are used for _____.

a. Separating clay from silt
b. Separating sands of different sizes
c. Neither of these
d. Both A and B

7. Which characteristic separates Amphipods from Foraminifera?

a. Protective covering
b. Live in salt water
c. Many pairs of feet

8. Foraminifera shells are of many varied shapes and sizes.

True or False

9. Copepods are most closely related to _____.

a. Mice
b. Crabs
c. Clams
d. Insects

10. Draw a foraminiferan seen in your sample in the space provided below. Label structural features.

Answers for Post Test

4. Order of use:

   a. map
   b. alcohol
   c. screen sieves
   d. microscope

5. Foraminifera

6. D, both A and B

7. C, many pairs of feet

8. True

9. B, crabs

10. —

Glossary

1. Aperture- opening in the last chamber of the foraminiferan shell
2. Arenaceous- referring to a shell made up of particles of silica, silt, or sand cemented together by the foraminifera.
3. Bottom Grab- mechanical device for taking a sediment sample from the bottom of a body of water.
4. Calcareous- made of calcium carbonate.
5. Chamber- one section of a foraminiferan shell, separated from other sections by a shell wall.
6. Coiled- turned or wound around a point.
7. Detritus- decomposing remains of plants and animals
8. Estuary- the area in which a river meets the ocean (e.g., Delaware Bay and Chesapeake Bay).
9. Imperforate- referring to a smooth-surfaced shell
10. Marine- referring to the salt water environment.
11. Perforate- referring to shells having many holes.
12. Proloculum- first chamber of a foraminiferan shell.
13. Protist - a one-celled organism.
14. Pseudopodia (false feet) - cell extensions of protists
15. Screen sieves- series of wire sieves used for separating particles of different sizes
16. Siliceous- referring to shells made up of silica, a very abundant earth material.
17. Silt- very fine particles of earth materials.
18. Species- name given groups of similar plants or animals having so many features in common (such as shape, feeding patterns growth habits) that interbreeding is possible.
19. Spiral- turned or wound around an axis
20. Test- a foraminiferan or diatom shell.

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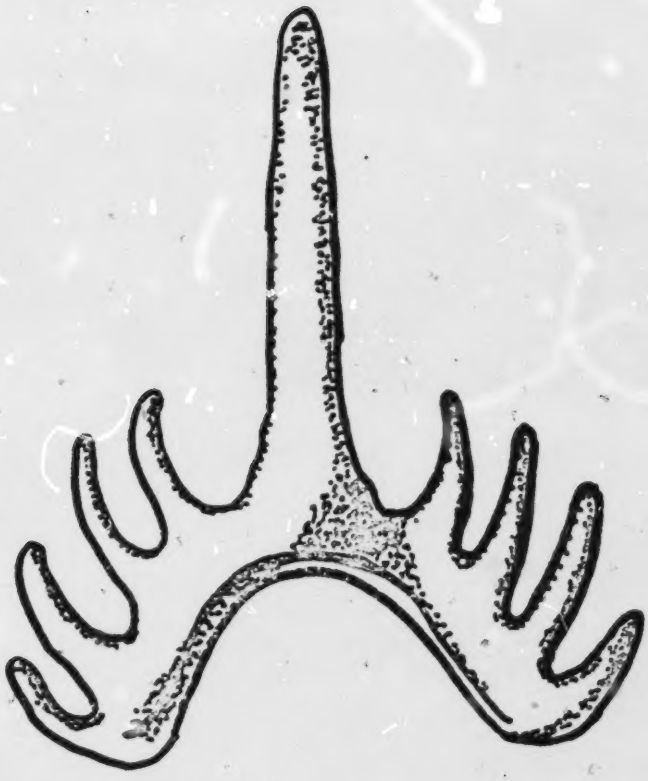
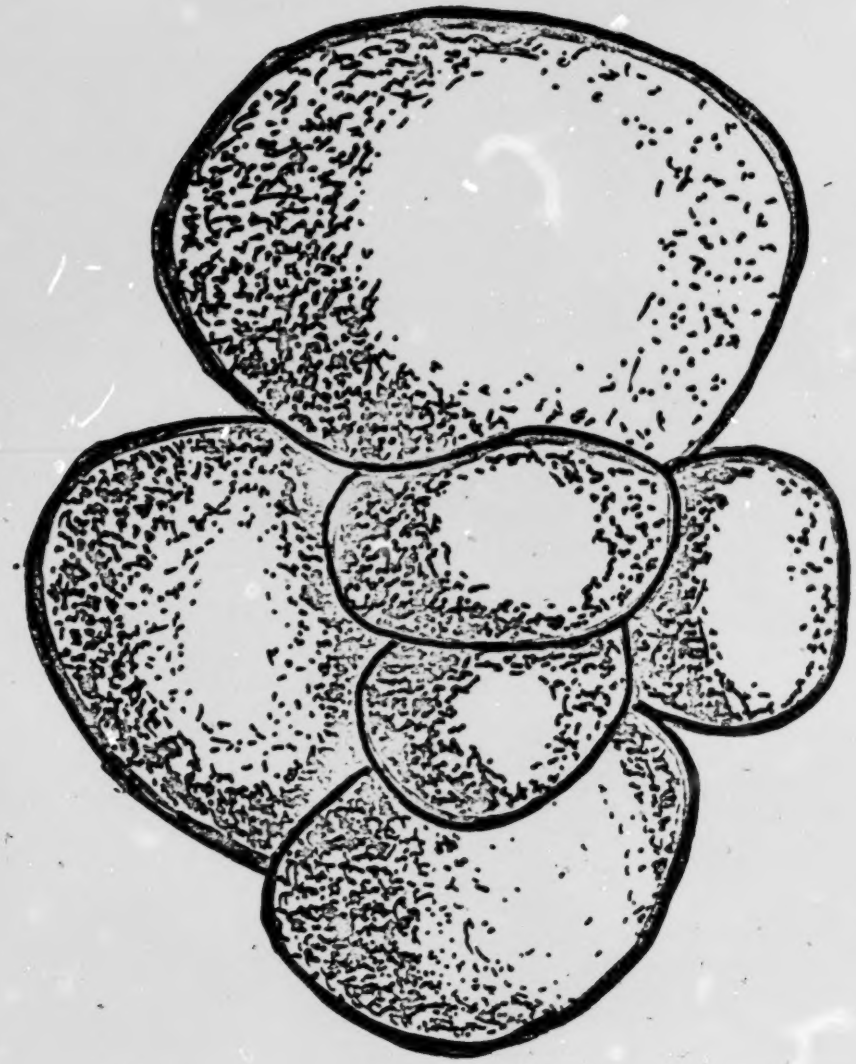


Scolecodonts

SCOLECODONTS

SCOLECODONTS



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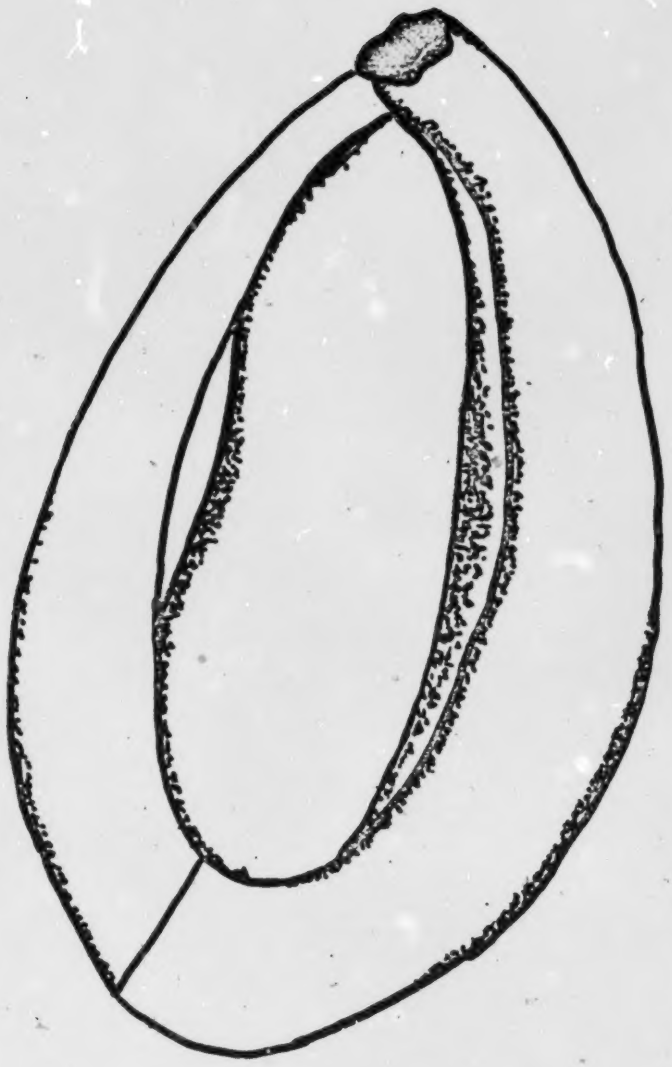

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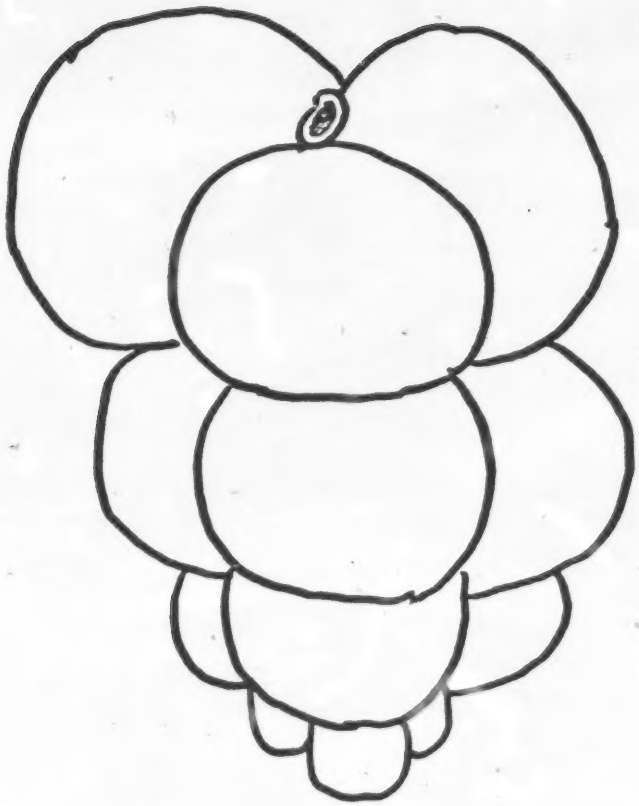

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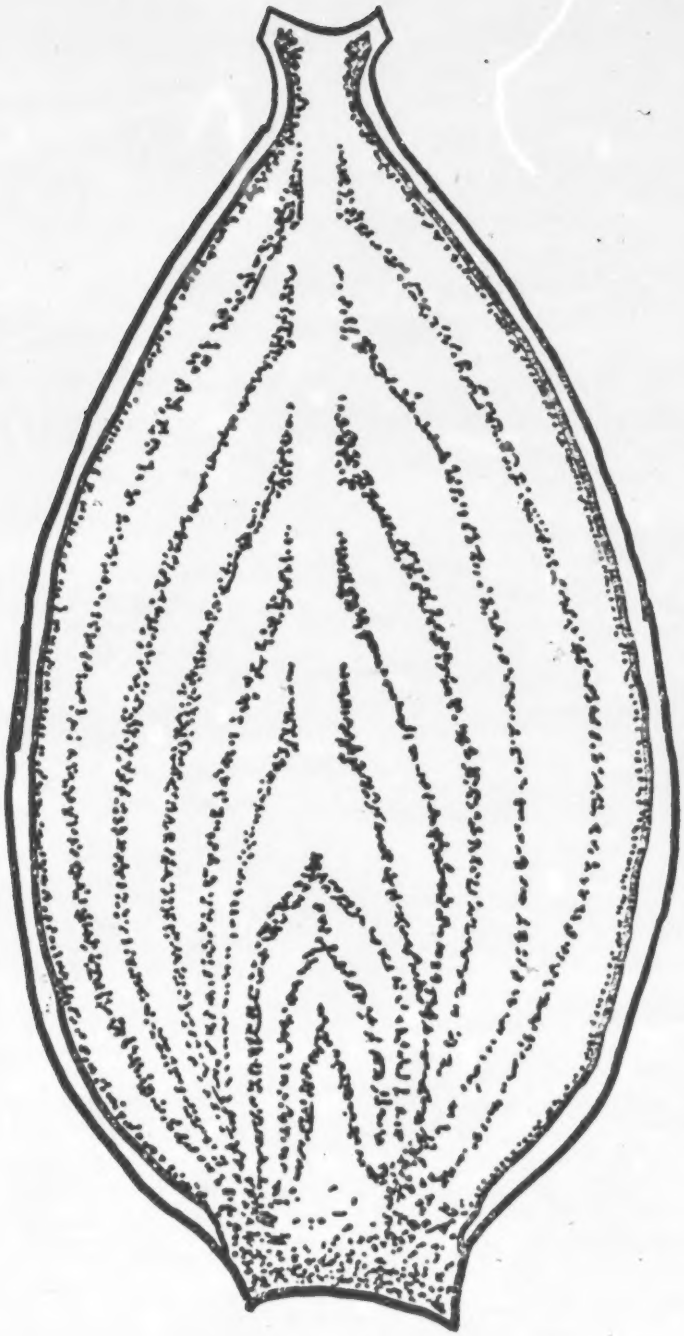

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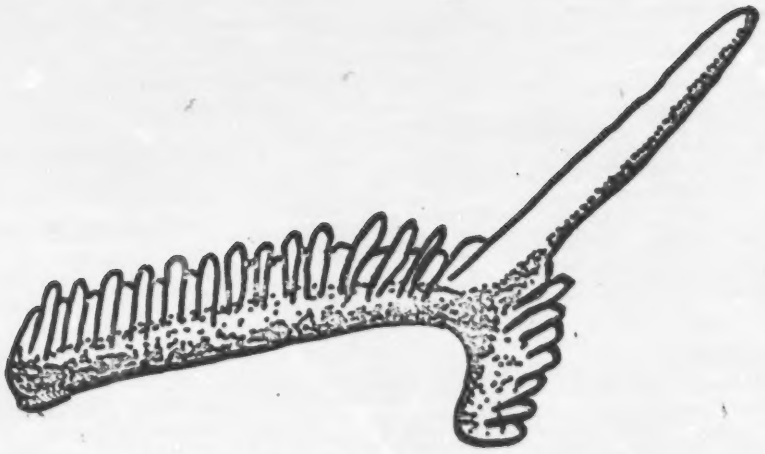

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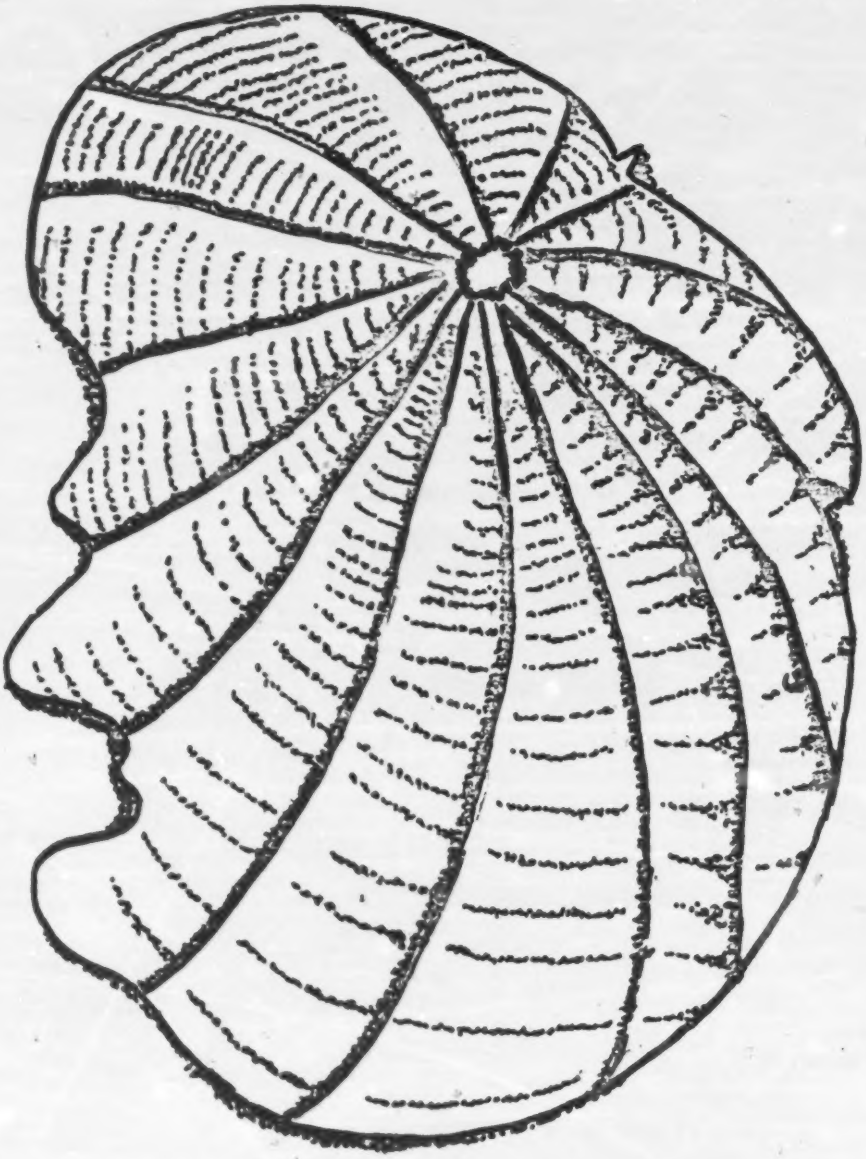

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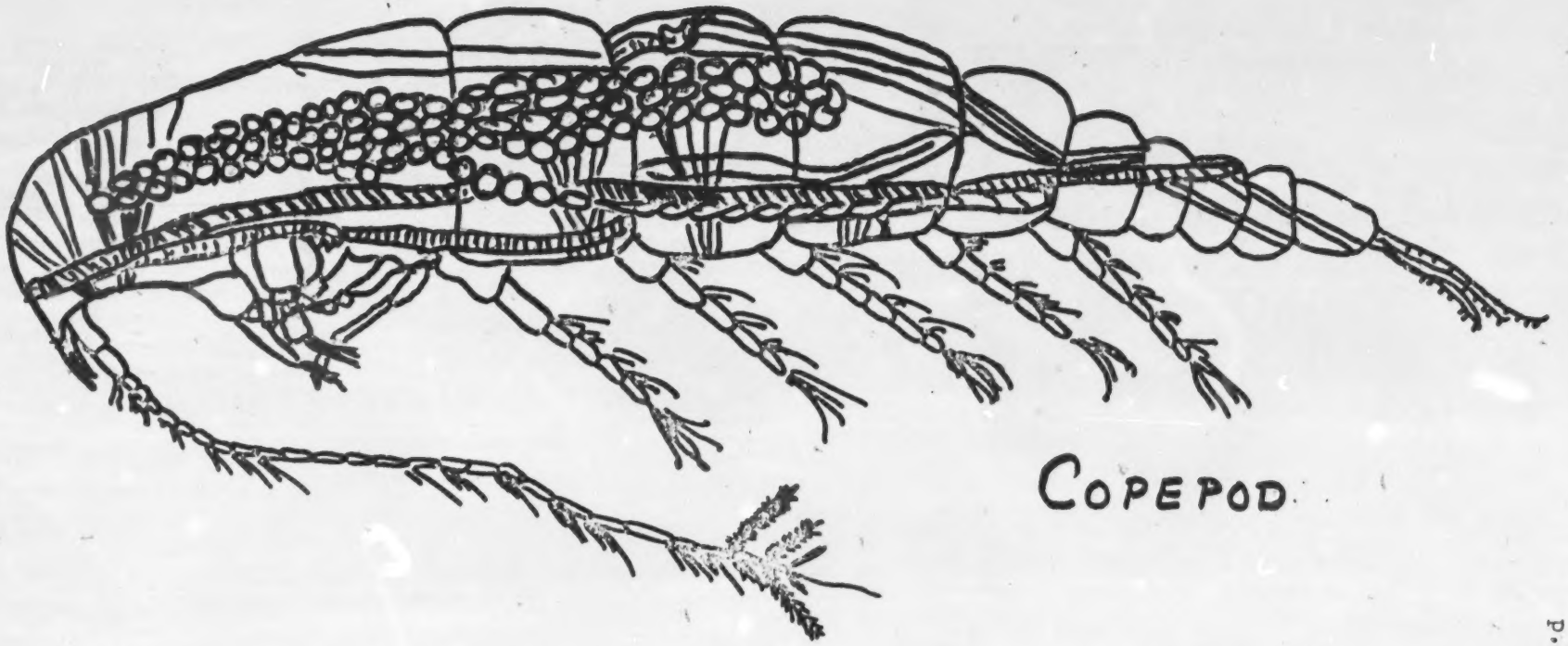

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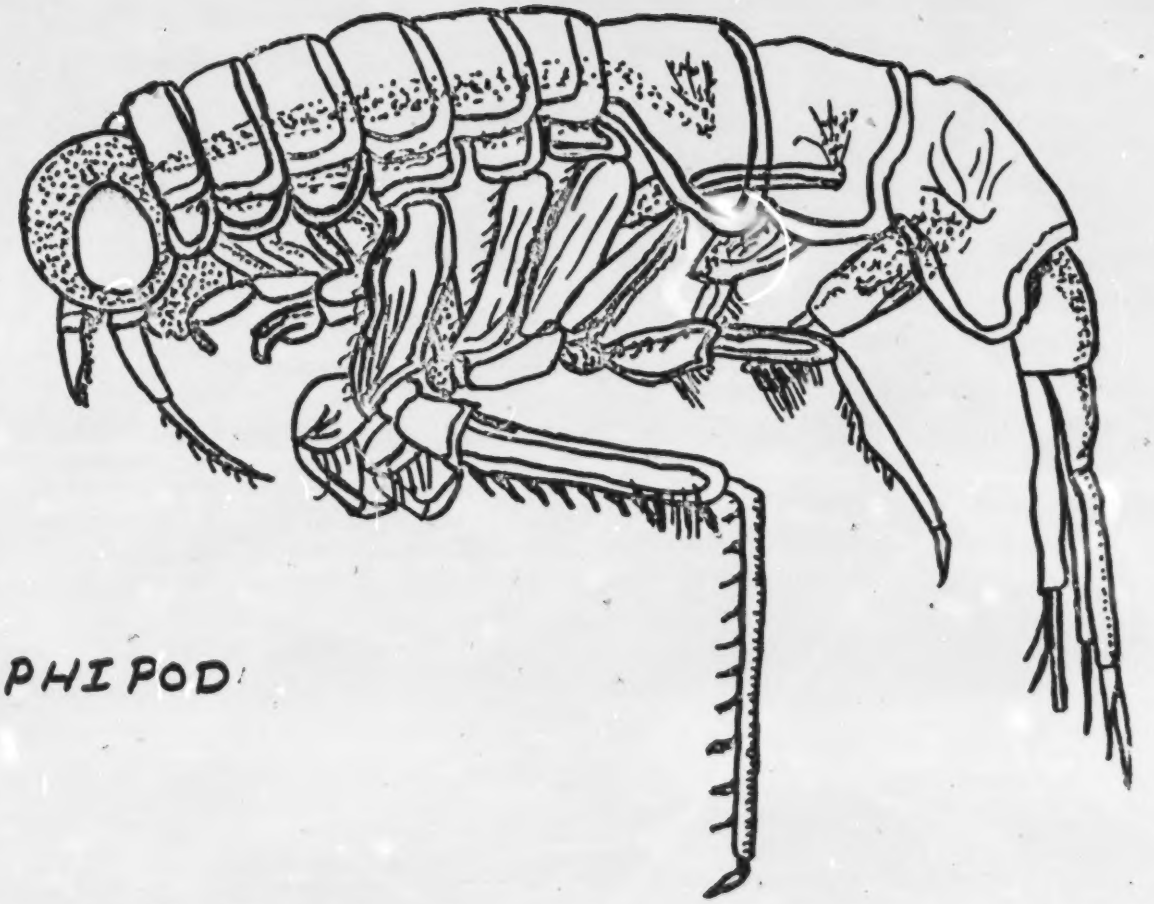

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